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2 For: Robust, Low-Resistance Elastomeric Conductive Polymer Interconnect

1 1. An elastomeric device for electrically interconnecting two or more
2 components, comprising,

3 an elastomeric matrix having one or more outer surfaces; and
4 one or more electrically conductive pathways through said matrix, wherein at
5 least a portion of the electrical pathway contains a material that is an electrically
6 conductive liquid at the elastomeric device's operating temperature.

1 2. The device of claim 1, further comprising one or more electrically
2 conductive contact pads, wherein at least a portion of said pad is in electrical contact with
3 one or more of said pathways.

1 3. The device of claim 1, wherein the electrically conductive liquid is a low
2 melting point metal or alloy.

1 4. The device of claim 3, wherein said metal is Gallium.

1 5. The device of claim 3, wherein said alloy contains one or more metals
2 selected from the group of metals consisting of Gallium, Indium, Bismuth, and Tin.

1 6. The device of claim 1, wherein said pathways are anisotropic and
2 comprise between about 2 to 50% magnetic particles by volume of said elastomeric
3 matrix.

1 7. The device of claim 1, wherein said matrix comprises one or more
2 elastomers which retains most of its elasticity over a temperature range of between at
3 least 20° C to 75° C.

1 8. A method for making an elastomeric device for electrically

2 interconnecting two or more components, comprising the steps of:

3 embedding a plurality of magnetic particles, coated with a low melting point

4 metal or alloy, in an elastomer by mixing the particles in the elastomer before the

5 elastomer sets;

6 applying a magnetic field to the particles so that the particles align themselves in

7 electrically isolated columns;

8 heating the matrix sufficiently to fuse the low melting point coating; and

9 polymerizing the elastomer to form an elastomeric matrix having one or more

10 outer surfaces and comprising one or more electrically conductive pathways through the

11 matrix.

1 9. The method of claim 8, wherein the uncured elastomer is coated on a

2 carrier that contains conductive pads.

1 10. The method of claim 8, wherein the uncured elastomer is coated on a

2 carrier that contains one or more metal layers, the method further comprising the step of

3 creating one or more electrically conductive pads that are electrically continuous with at

4 least one electrically conductive pathway through the matrix.

1 11. An elastomeric device for electrically interconnecting two or more
2 components, comprising a matrix of electrically insulating elastomer that retains most of
3 its elasticity over a temperature range of at least 20°C to 75°C, containing an array
4 columns that are electrically conductive liquid over at least the upper range of the use
5 temperature of the device.

1 12. The device of claim 11, further comprising one or more electrically
2 conductive contact pads in electrical contact with said columns.

1 13. A method for making an elastomeric device for electrically

2 interconnecting two or more components, comprising the steps of:

3 creating an array of low melting point metallic columns on a carrier; and

4 laterally encapsulating said array in an electrically isolating elastomeric matrix.

- 1 14. A method for making an elastomeric device for electrically
- 2 interconnecting two or more components, comprising the steps of:
- 3 creating an array of openings in an electrically isolating elastomeric matrix; and
- 4 filling the openings with a material that is an electrically conductive liquid over at
- 5 least the upper range of the use temperature of the device.

1 15. An elastomeric device for thermally interconnecting two or more
2 components, comprising a matrix of electrically insulating elastomer that retains most of
3 its elasticity over a temperature range of at least 20°C to 75°C, containing an array of
4 columns that include thermally conductive liquid metal over at least the upper range of
5 the use temperature of the device.